



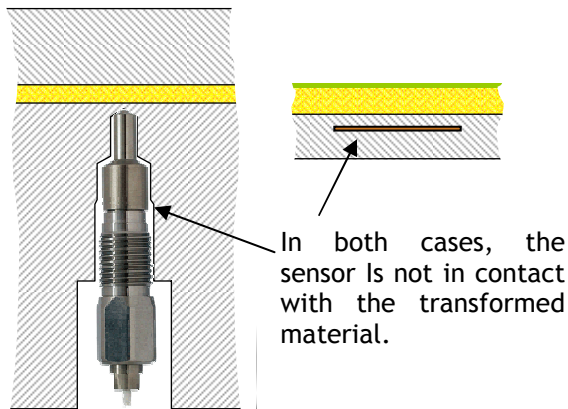
**Goals:** Non intrusive resin flow front detection, reaction start and end; real-time cure monitoring.  
**Applications:** Vent control, R&D, Real Injection and Cure recordings.  
**Domains:** Aerospace, Nautical, Automotive.

**Principle:** Resin injection in composites is followed by heat transfer which is highly sensitive to processing conditions. The quality of heat flux sensors allows to detect resin flow front and to monitor the cure without direct contact with the material to be transformed.

**Sensor positioning:** Sensors are integrated inside tooling with different possibilities.

Steel, or aluminium tool (composite)

RTM-light (composite)

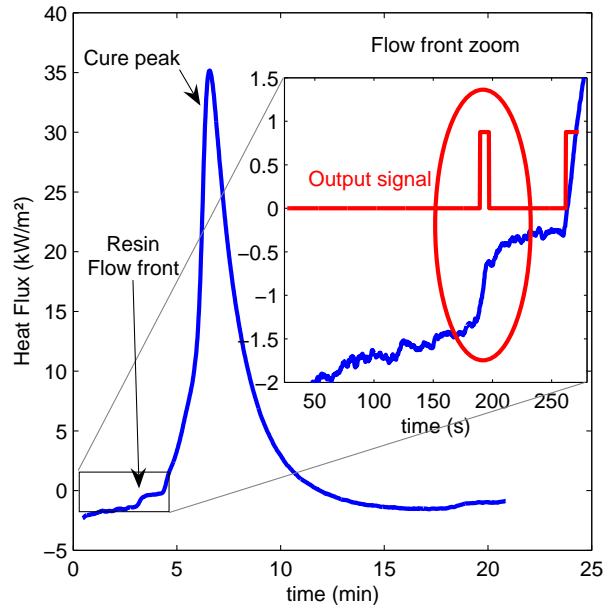


**Measured properties:** Local Heat Flux and tool temperature. Resin Flow Front is detectable thanks to the thermal disturbance which is brought by the resin during fibre impregnation (slight difference in temperature and local thermal conductivity). **Cure reaction** provide heat which is detected by the sensor. It is therefore possible to monitor cure providing the fact the thermal regulation is stable.

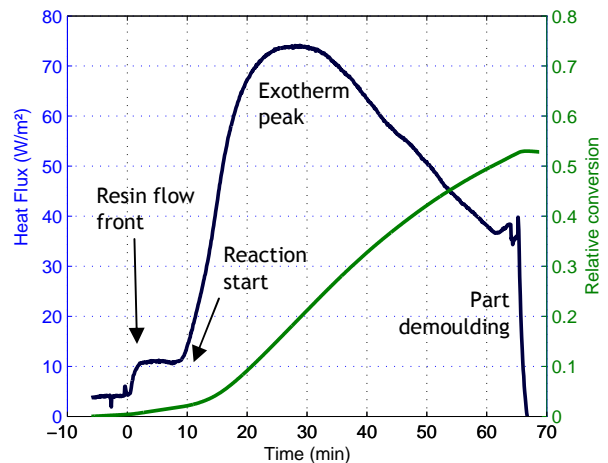
**Kinetic** analysis is similar to the DSC (Differential Scanning Calorimetry) one with some differences due to real thermal cycles. Indeed, cure signal is averaged on part's thickness. For thick components, temperature gradients can be large and may induce variations in reactivity through composite's thickness.

**Applications:** Quite useful for process understanding and optimization (R&D), the system can be also used in production environment for production (Quality control). Thermoflux Technologies proposes a embedded dedicated electronic system which

can automatically control vents according to flow front detection.



Heat Flux signal on a Metallic RTM tool



Heat Flux signal and real-time conversion obtained on a RTM light (composite) tool.

After calibration, it is also possible to monitor in real time the instant cure level, and stop cure at minimum cure value. This allows optimisation of productivity for a constant cure level.